

**Background:**

An outbreak has occurred at a school in Ohio. Approximately 30 students have come down sick with symptoms ranging from cramps to loss of appetite. The first accounts of the mystery illness have come from the school's nurse. I have included a copy of the information she emailed to me for you to examine. At this time it appears as though the pathogen is foodborne. Unfortunately, we don't know what food lead to the infections. The pathogen is also unknown.

I'll bring in updates each day this week so we can consider the most up to date information.

I involved us in the investigation because I thought we might be able to help. I'm hopefully that we'll have some answers by Friday. Then we can prepare to submit a report to the CDC. As we go through this stay as focused as possible. The more you can keep in mind what you know about pathogens and epidemics the better we'll do.

Sincerely,

Mr. Wells

P.S. I'm going to set it up so this can count in place of a test for you. I'll give you a rubric tomorrow.

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From: Betty Hartford <bhartford@oh.k12.org>  
to: Andrew Wells <awells@latinpcs.org>  
date: Fri, Mar 7, 2014 at 4:27 PM  
subject: tracking docs

--Line Listing: Victims, Onset, Symptoms--

sex	ID#	init.	onset time	physician	symptoms
F	1	AT	8 pm	Dr. Harris	diarrhea, fever, abdominal cramps
M	2	BN	8:15	Warren	diarrhea, cramps
F	3	RC	after dinner	?	fever, cramps
M	4	BJ	9 pm	?	diarrhea, fever, cramps
M	5	CS	midnight	Farrell	fever, cramps, nausea, headache
M	6	DF	9:30	Harris	fever, diarrhea, cramps
M	7	GB	8:30	Dr. Horner	diarrhea, fever, cramps, aches
F	8	RV	8	?	fever, chills, headache, nausea
M	9	AT	10	?	fever, upset stomach, diarrhea
M	10	BW	7:15	Foley	fever, body aches, nausea, diarrhea
M	11	JR	9 pm	Harris	diarrhea (bad)
F	12	TC	8	Logan	headache, nausea, fever, diarrhea
F	13	HP	8:30	Foley	diarrhea, cramps
M	14	AC	10ish	?	fever, chills, sweating, diarrhea
M	15	SC	7:45	Logan	stomach ache
M	16	RW	8	?	diarrhea, fever, chills, nausea
M	17	FT	9:00	Harris	diarrhea, fever, cramps
F	18	HS	9	Harris	fever, diarrhea
M	19	GW	8	Foley	fever, diarrhea, vomiting
F	20	NL	7:45	Wentz	diarrhea, fever, loss of appetite
M	21	CC	8 pm	?	sweating, diarrhea
F	22	JM	morning	Kipling	headache
M	23	RW	8pm	?	fever, diarrhea
F	24	BN	7	?	nausea, diarrhea
M	25	TR	10	?	just diarrhea
M	26	GF	9	Harris	nausea, diarrhea, cramps
M	27	AD	9:15	Barker	fever, diarrhea
F	28	MK	9:30	Dr. Warren	diarrhea, fever, cramps
	29				
	30				Prepared by: B. Hartford, RN



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## few questions from my students

Messages

**Andrew Wells** <awells@latinpcs.org>  
To: Betty Hartford <bhartford@oh.k12.org>

Mon, Mar 10, 2014 at 4:27 PM

Hi Betty :-

Nice to hear from you on Friday. I am sorry things are so hectic for you, but I talked to my students and we're excited to help. I really think we're going to be able to figure this out.

There are a few things that came up in class that we'd like to have if you can send them along. They are:

- A school menu from last week
- A list of what the sick students ate
- The day the sickness started on
- If you have any of the other doctor's names
- Where your school is located

Thanks for sending anything you can. I understand if it's not available yet or you can't send it because it's confidential.

Andrew

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As of June 15, calls should be made to 223-1111.  
This will be the main number for the school at our new campus.

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**Betty Hartford** <bhartford@oh.k12.org>  
Andrew Wells <awells@latinpcs.org>

Mon, Mar 10, 2014 at 4:35 PM

Andrew, Thats great!

About your questions...my school is in a town called Medina. I don't have the other doctor's names (the question marks on the sheet I sent you means it's not listed in the school directory). Kids first started coming into my office on Thursday. One or two of them were back at school today, but most we still home sick.

I can probably get a menu from last week. I have been keeping a log of who ate what, but I hadn't tried match it with the menu yet. I'll send both a bit later tonight.

Best,  
Betty

[Quoted text hidden]

From: Betty Hartford <bhartford@oh.k12.org>  
to: Andrew Wells <awells@latinpcs.org>  
date: Mon, Mar 10, 2014 at 8:21 PM  
subject: Menu and counts

Food Item Eaten	Number sick	Number not sick
meatball sub	//// //// //// ////	//// //// //// ////
cheeseburger	//// /	//// /
salad	////	//// ////
macaroni & cheese	//// ///	//// //// //
ice cream	//	//// //// //
fruit cup	//// //// //	//// //// ///
milkshake	//// //// //// //// ////	////
French fries	//// //// ////	//// ////
milk	//// /	//// /
juice	//	//// //// //
nachos	//// ///	//// ////

# OUTBREAK INVESTIGATION DATA

-----Possible Sources: Food Sources-----

## NUTRI-SERVE SCHOOL FOOD SERVICES

### Vendor, Food and Ingredients Listing

#### **DMG Supply**

##### **cheeseburger**

- seasoned ground beef
- American cheese
- sesame seed buns
- lettuce
- tomato
- catsup

##### **French fries**

- potatoes
- vegetable oil

##### **juice**

- apple juice from concentrate

##### **macaroni & cheese**

- macaroni noodles
- cheddar cheese
- salt
- butter
- milk

##### **meatball sub**

- ground beef
- bread crumbs
- eggs
- french bread
- mozzarella cheese
- spices
- tomato sauce
- sugar
- salt
- whole tomatoes

##### **milk**

- 2% regular
- 2% chocolate
- skim

##### **nachos**

- tortilla chips
- cheddar cheese sauce
- jalapeño peppers

#### **Market Source, Inc.**

##### **fruit cup**

- peaches
- pears
- grapes

##### **ice cream**

- cream
- sugar
- vanilla

##### **salad**

- lettuce
- cabbage
- carrots
- mushrooms
- green peppers
- radishes
- diced chicken
- cheddar cheese
- ranch or Italian dressing

#### **Coliville Custard Co.**

##### **milkshake**

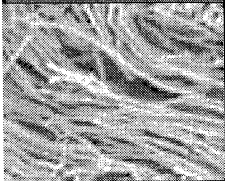
- cream
- sugar
- eggs
- vanilla
- milk

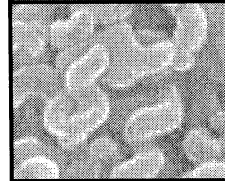
# FOODBORNE ILLNESS: THE USUAL SUSPECTS


## Bacteria

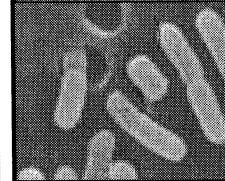
### GRAM-POSITIVE (+)


### GRAM-NEGATIVE (-)

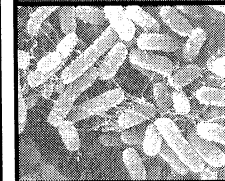
<b>Bacillus Cereus</b>	<b>TYPE:</b> Large rods
	<b>INCUBATION PERIOD:</b> 1-6 hours <b>SYMPTOMS:</b> sudden onset of severe nausea, vomiting <b>DURATION OF ILLNESS:</b> 24 hrs <b>SUSPECT FOODS:</b> fried rice, meats


<b>Campylobacter</b>	<b>TYPE:</b> Curved rods
	<b>INCUBATION PERIOD:</b> 2-5 days <b>SYMPTOMS:</b> Diarrhea, cramps, nausea, vomiting <b>DURATION OF ILLNESS:</b> 2-10 days <b>SUSPECT FOODS:</b> poultry

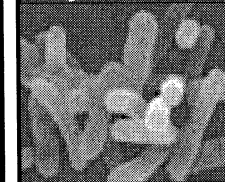
<b>C. perfringens</b>	<b>TYPE:</b> Spore-forming rod
	<b>INCUBATION PERIOD:</b> 8-16 hours <b>SYMPTOMS:</b> watery diarrhea, abdominal cramps, nausea <b>DURATION OF ILLNESS:</b> 24-48 hrs <b>SUSPECT FOODS:</b> meats, gravies

<b>E. Coli</b>	<b>TYPE:</b> Rods
	<b>INCUBATION PERIOD:</b> 12-48 hours <b>SYMPTOMS:</b> watery diarrhea, abdominal cramps, nausea <b>DURATION OF ILLNESS:</b> 3-7 days <b>SUSPECT FOODS:</b> varies (fecal/oral)

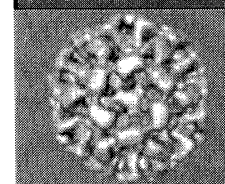
<b>Listeria</b>	<b>TYPE:</b> Rods
	<b>INCUBATION PERIOD:</b> 9-48 hours <b>SYMPTOMS:</b> Fever, muscle aches, nausea, diarrhea <b>DURATION OF ILLNESS:</b> varies <b>SUSPECT FOODS:</b> cheese, meats


<b>Salmonella</b>	<b>TYPE:</b> Rods
	<b>INCUBATION PERIOD:</b> 6-36 hours <b>SYMPTOMS:</b> Fever, diarrhea, abdominal cramps, vomiting <b>DURATION OF ILLNESS:</b> 4-7 days <b>SUSPECT FOODS:</b> eggs, poultry

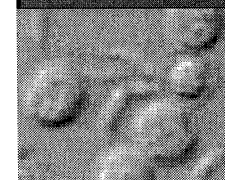
<b>Staphylococcus</b>	<b>TYPE:</b> Cocci (ball-shaped)
	<b>INCUBATION PERIOD:</b> 1-6 hours <b>SYMPTOMS:</b> severe vomiting, nausea, abdominal cramps, fever <b>DURATION OF ILLNESS:</b> 24-48 hrs <b>FOODS:</b> meats, salads, cream pastries

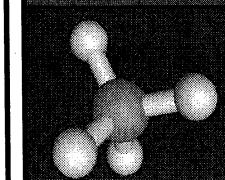
<b>Shigella</b>	<b>TYPE:</b> Rods
	<b>INCUBATION PERIOD:</b> 24-48 hours <b>SYMPTOMS:</b> Fever, abdominal cramps, diarrhea <b>DURATION OF ILLNESS:</b> 4-7 days <b>SUSPECT FOODS:</b> varies (fecal/oral)

## Other possible culprits

<b>Viruses</b>	<b>TYPES:</b> Norwalk (shown), rotavirus
	<b>INCUBATION PERIOD:</b> 10-72 hours <b>SYMPTOMS:</b> nausea, vomiting, watery diarrhea <b>DURATION OF ILLNESS:</b> varies <b>SUSPECT FOODS:</b> varies (fecal/oral)

<b>Marine Toxins</b>	<b>TYPES:</b> Pufferfish (shown), shellfish
	<b>INCUBATION PERIOD:</b> 1 min-3 hours <b>SYMPTOMS:</b> vomiting, nausea, paralysis, death <b>DURATION OF ILLNESS:</b> varies <b>SUSPECT FOODS:</b> seafood

<b>Parasites</b>	<b>TYPES:</b> Cryptosporidium (shown)
	<b>INCUBATION PERIOD:</b> > 24 hours <b>SYMPTOMS:</b> varies (nausea, fever, vomiting, diarrhea, cramps) <b>DURATION OF ILLNESS:</b> >48 hours <b>SUSPECT FOODS:</b> varies

<b>Chemicals</b>	<b>TYPES:</b> Metals (tin, copper), arsenic
	<b>INCUBATION PERIOD:</b> 1 min-2 hours <b>SYMPTOMS:</b> vomiting, diarrhea, nausea <b>DURATION OF ILLNESS:</b> <24 hours <b>SUSPECT FOODS:</b> varies



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**My updates?**

Messages

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**Andrew Wells** <awells@latinpcs.org>

Wed, Mar 12, 2014 at 4:27 PM

To: Betty Hartford &lt;bhartford@oh.k12.org&gt;

Betty –

Thanks for the information you sent on Monday. It was helpful to see what was served and how many ended up getting sick. Even though you were busy yesterday and couldn't write back I found out about a formula called "*attack rate*". It lets you know how risky a food is if you ate it. My students found out that the milkshake seems the riskiest right now (87%), but we can't say it's that for sure until we get a little more information. If possible, can you tell us how many people didn't eat school lunch but still got sick?

When we know that we can calculate the "*relative risk*". Relative risk will let us know which food that has the strongest link to the sickness (sorry for the explanation if you know about relative risk already). From there, all we have to do is ID the pathogen! I think we're on track to know by Friday. Has the health department figured it out yet?

Lastly, here are the things my students need to know if you can help out:

- are there any new infections since last week?
- are any of the sick students better now?
- how many people are still sick?
- did any kids start feeling sick right after lunch? (we're trying to figure out the incubation period)
- are any teachers sick?
- what times are breakfast and lunch at your school?

I know this is kind of a lot to ask and I'm sure you're busy, but we're close and I really think we're going to figure this out!

Your amigo,  
Andrew

**As of June 15**, calls should be made to 223-1111.

This will be the main number for the school at our new campus.

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**Betty Hartford** <bhartford@oh.k12.org>

Wed, Mar 12, 2014 at 8:09 PM

To: Andrew Wells &lt;awells@latinpcs.org&gt;

Hey Andrew, This is so cool. I was happy to have your students follow the investigation, but I wasn't taking you so seriously that they would be able to contribute to the outbreak investigation.

The city health department also identified the risk of the milkshake so it sounds like you're on the right track. They haven't named the food for sure though. FYI: I am familiar with "relative risk" and, you're right, that's important to find out before you can say for sure.

Okay, here's everything else I know:

- No teachers really eat the school lunch here. They can leave campus if they want because they don't eat lunch with students like you do.
- There have been no new infections at my school since Friday (at least none reported), but a few kids were sick at another school across town I found out.
- 18 of the children who were sick last Thursday are now back at school as of today (but yesterday there were only 7 back at school)
- Kids 1-22 on the list were sick on Thursday. The earliest onset time was for #10 (@ 7:15 Thursday night). Everyone else was sick on Friday.
- Breakfast is served at 7:00 - 7:30 am and lunch is served from 11:00 am - 1:00 pm

I'm including a graph that we used to use in nursing school to track the times people got sick. It's useful when you are looking for patterns. If you can't use it then no big deal.

Good luck!

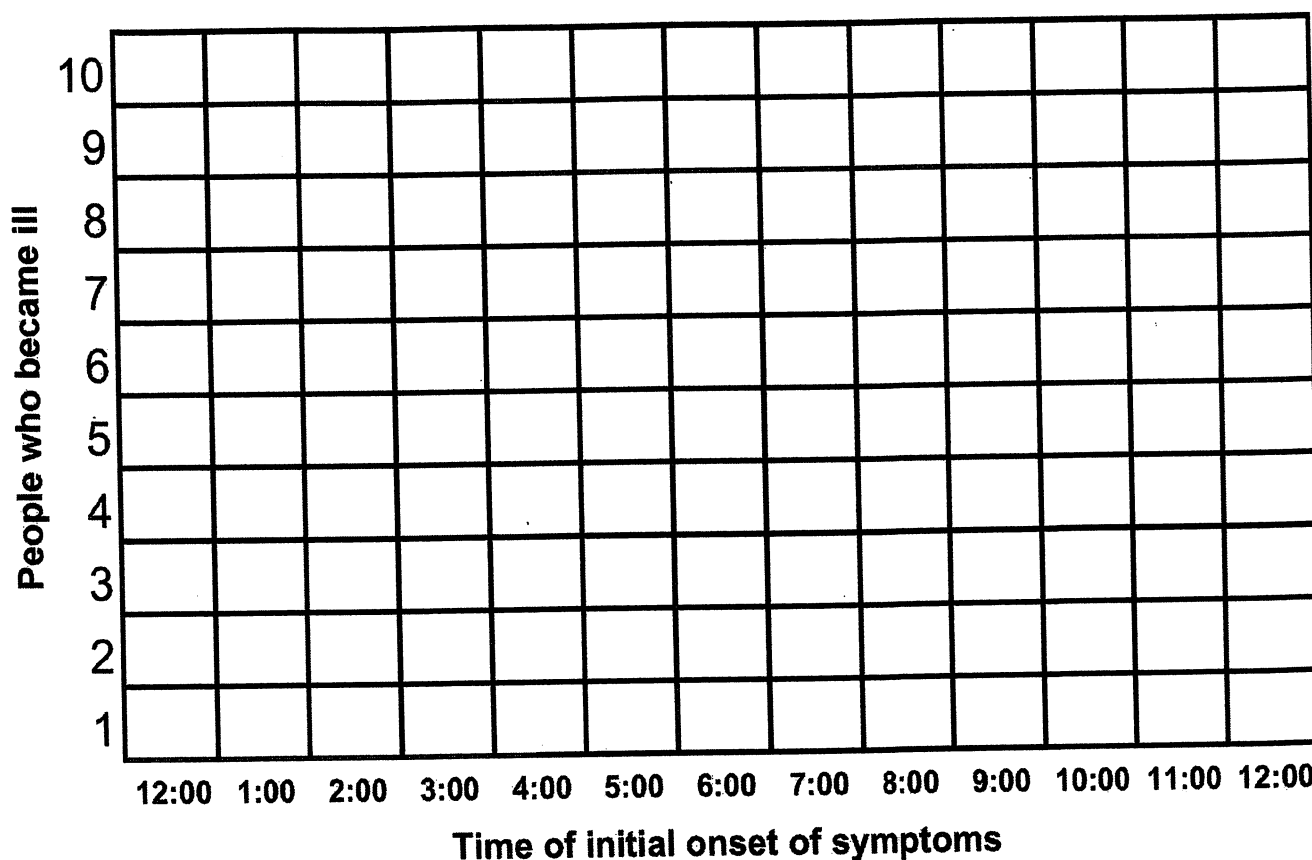
P.S. all the times on my epichart are pm unless they say otherwise.

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**As of June 15**, calls should be made to 223-1111.

# Epidemic Curve for Acute Gastroenteritis - 12 Hour Period



## INSTRUCTIONS:

Fill in the grid above to create a **histogram** (bar graph) of the time of **onset** of first **symptoms**. Use a pencil to shade in one box for each person who become ill at each time point, beginning with 1 and working upward. Do you see a pattern? Determine the **incubation period** for the illness by calculating the time between **exposure** (the time the food was eaten) and the time when the first symptoms were observed as recorded above. What is shortest observed incubation time? \_\_\_\_ What is the longest? \_\_\_\_ Can you determine the median incubation period? \_\_\_\_ Can you calculate the average (mean) incubation period? \_\_\_\_ Why didn't everyone get sick at the same time?



DID NOT EAT

	SICK	UN SICK
Meatball Sub		
<del>Cheeseburger</del>		
Salad		
Macaroni & cheese		
Ice Cream		
Fruit Cup		
Milkshake		
French Fries		
Milk		
Juice		
Mentos		

# OUTBREAK INVESTIGATION ANALYSIS

-----Calculate Relative Risk-----

<b>①</b> Use a 2x2 table to organize your data for a likely food item.				<b>②</b> Calculate attack rate using data from step 1.			
Food item:	<b>A</b> # ill	<b>B</b> # not ill	<b>C</b> Totals	<b>attack rate % = (A + C) × 100</b>			
# did eat				did eat	=	X	
# did not eat				did not eat	=	Y	
Totals				<b>③</b> Calculate <b>relative risk</b> = (X ÷ Y) =			

<b>①</b> Use a 2x2 table to organize your data for a likely food item.				<b>②</b> Calculate attack rate using data from step 1.			
Food item:	<b>A</b> # ill	<b>B</b> # not ill	<b>C</b> Totals	<b>attack rate % = (A + C) × 100</b>			
# did eat				did eat	=	X	
# did not eat				did not eat	=	Y	
Totals				<b>③</b> Calculate <b>relative risk</b> = (X ÷ Y) =			

<b>①</b> Use a 2x2 table to organize your data for a likely food item.				<b>②</b> Calculate attack rate using data from step 1.			
Food item:	<b>A</b> # ill	<b>B</b> # not ill	<b>C</b> Totals	<b>attack rate % = (A + C) × 100</b>			
# did eat				did eat	=	X	
# did not eat				did not eat	=	Y	
Totals				<b>③</b> Calculate <b>relative risk</b> = (X ÷ Y) =			